Self-organization on Nano Scales:
Fabrication beyond the Top-down and Bottom-up by Harnessing Thin Film Instabilities

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Inexpensive, fast and large-area nanofabrication across a variety of materials remains a challenge which impacts important advances in functional interfaces, energy, electronics, health and environment. This talk will summarize some of our recent work on understanding and control of self-organization and instabilities in thin soft films. The focus will be on fabrication of large area nano/micro patterns and structures by harnessing of self-organized instabilities. I will illustrate the basic principles by examples from *Directed Dewetting* of thin (5 nm-100 nm) polymer liquid films, *Elastic Contact Instability* of soft solid films, *Electric Field Modulation* of Interfaces, *Directed Electrospinning* and *Diffraction Patterned Induced Self-organization*. An important point discussed will be a unique strategy to reduce the length scale of physical self-organizational processes from tens of micrometers to sub-100 nm levels that are characteristic of chemical self-assembly. Applications range from textured coatings, multiscale composites, cell-scaffolds, supported catalysis, nanolens and nanowire arrays to a reusable pressure sensitive adhesive with a nano-skin. This talk will be a tribute to the pioneering work initiated by Prof. Ruckenstein and his coworkers on thin films in the 70s and 80s.